

AUTOMATED TRAFFIC SIGNAL PERFORMANCE MEASURES

ITS 3C Summit – September 15, 2014

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Utah Department of Transportation



Proudly Presented by:



The Need

- How to we manage traffic signals?
 - Complaints
 - Look at it every few years for a few hours
 - Rely on models
-
- What happens on the weekend stays on the weekend (same with holidays, middle of the night, ...)

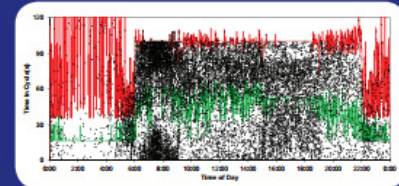


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PERFORMANCE MEASURES FOR TRAFFIC SIGNAL SYSTEMS

An Outcome-Oriented Approach



Christopher M. Day, Darcy M. Bullock, Howell Li, Stephen M. Remias, Alexander M. Hainen,
Richard S. Freije, Amanda L. Stevens, James R. Sturdevant, and Thomas M. Brennan



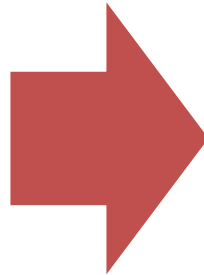
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SPM Basic Concept

Automated Data
Collection

- Signal controller
- Probe source



Useful Information
about Performance

- Signal
- Corridor
- System

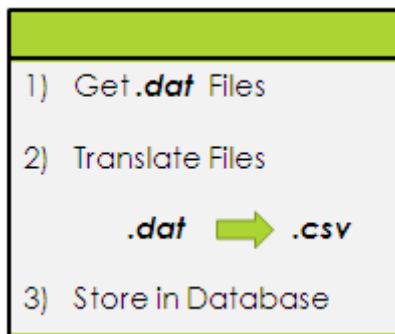
System Requirements for SPM



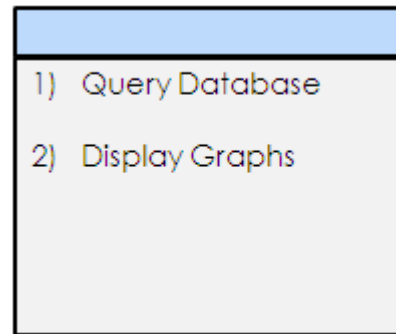
High-resolution Controller



Communications



Server



Website



Detection
(optional)

Can be done independent of a central system!

Sample Controller Log

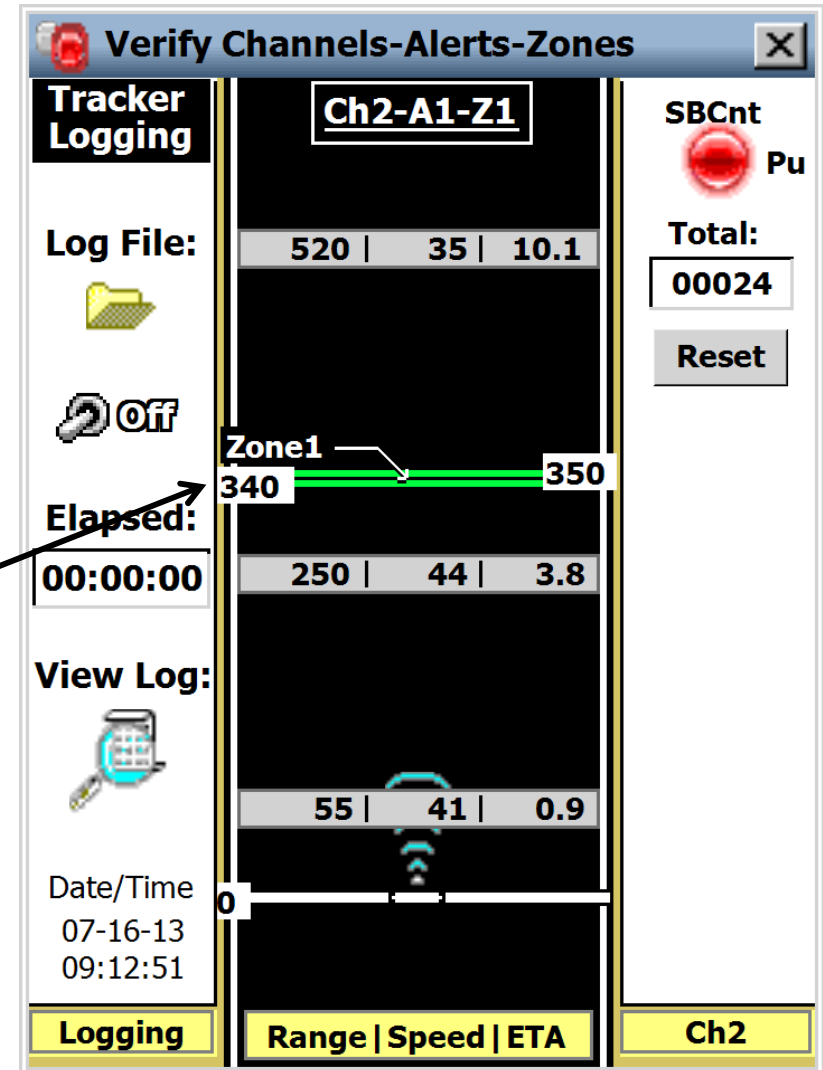
				Timestamp	Event Code	Event Parameter
Detector 5 ON				6/27/2013 1:29:51.1	10	8
				6/27/2013 1:29:51.1	82	5
				6/27/2013 1:29:52.2	1	2
				6/27/2013 1:29:52.2	1	6
				6/27/2013 1:29:52.3	82	2
				6/27/2013 1:29:52.8	82	4
				6/27/2013 1:29:52.9	81	4
				6/27/2013 1:29:53.3	81	6
				6/27/2013 1:29:54.5	81	2
				6/27/2013 1:30:02.2	8	2
				6/27/2013 1:30:02.2	8	6
				6/27/2013 1:30:02.2	33	2
				6/27/2013 1:30:02.2	33	6
				6/27/2013 1:30:02.2	32	2
				6/27/2013 1:30:02.2	32	6
Phase 8 GREEN				6/27/2013 1:30:06.1	10	2
				6/27/2013 1:30:06.1	10	6
Detector 5 OFF				6/27/2013 1:30:08.1	1	8
				6/27/2013 1:30:13.1	32	8
				6/27/2013 1:30:15.8	81	5
				6/27/2013 1:30:18.5	82	6
				6/27/2013 1:30:27.5	81	6
				6/27/2013 1:30:30.4	8	8

Advance Count Detectors

Wavetronix Advance

- Used to timestamp vehicle arrivals
- 10' count zone placed ~350' behind stop bar
- No additional expense if already in place for dilemma zones
- May undercount dense traffic

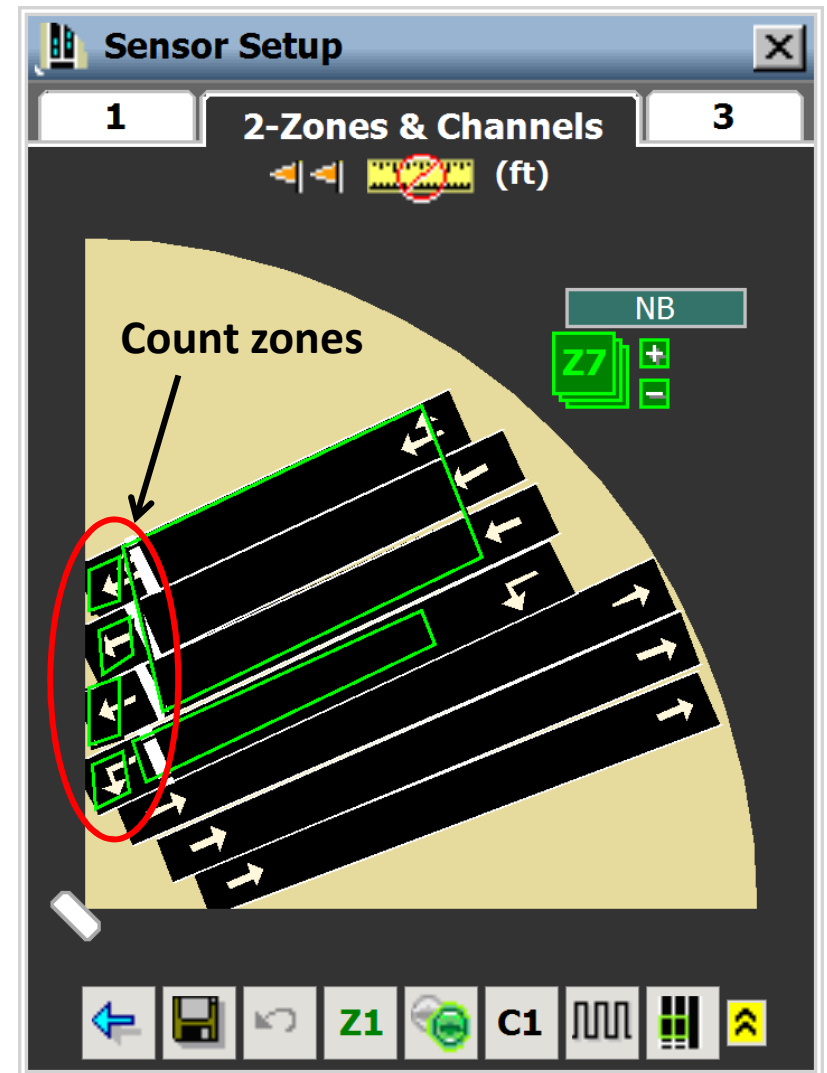
Count zone



Stop Bar Count Detectors

Wavetronix Matrix

- Used for turning movement counts
- Lane-by-lane detection zones in front of stop bar
- Requires detection rack card for every two zones (\$\$\$\$\$\$) or Click 650 Detector BIU



Types of Performance Metrics

Controller high-resolution data only

- ★ Purdue Phase Termination
- ★ Split Monitor



Advanced Count Detection (~400 ft behind stop bar)

- ★ Purdue Coordination Diagram
- Approach Volume
- Platoon Ratio

Arrivals on Red
Approach Delay
Executive Summary Reports

Advanced Detection with Speed

Approach Speed

Lane-by-lane Presence Detection

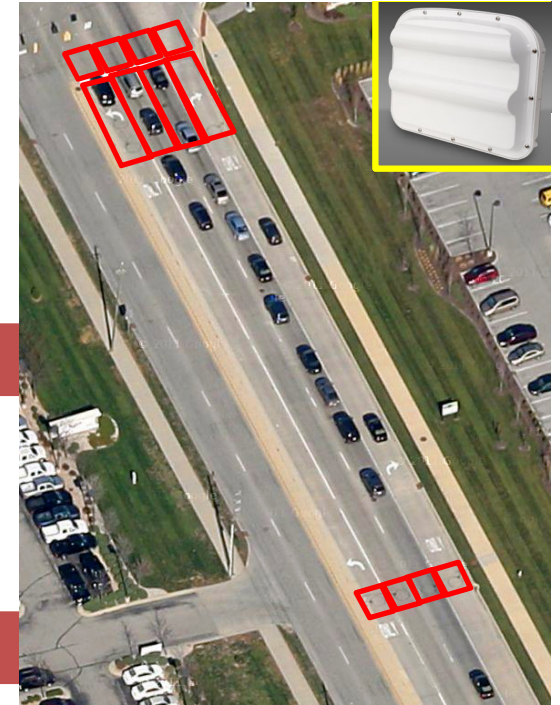
Split Failure (future)

Lane-by-lane Count Detection

Turning Movement Counts

Probe Travel Time Data (GPS or Bluetooth)

Purdue Travel Time Diagram



->Signal Metrics

Selected Signal

7055 Bangerter Hwy (SR-154) SR-201 DDI

Signals

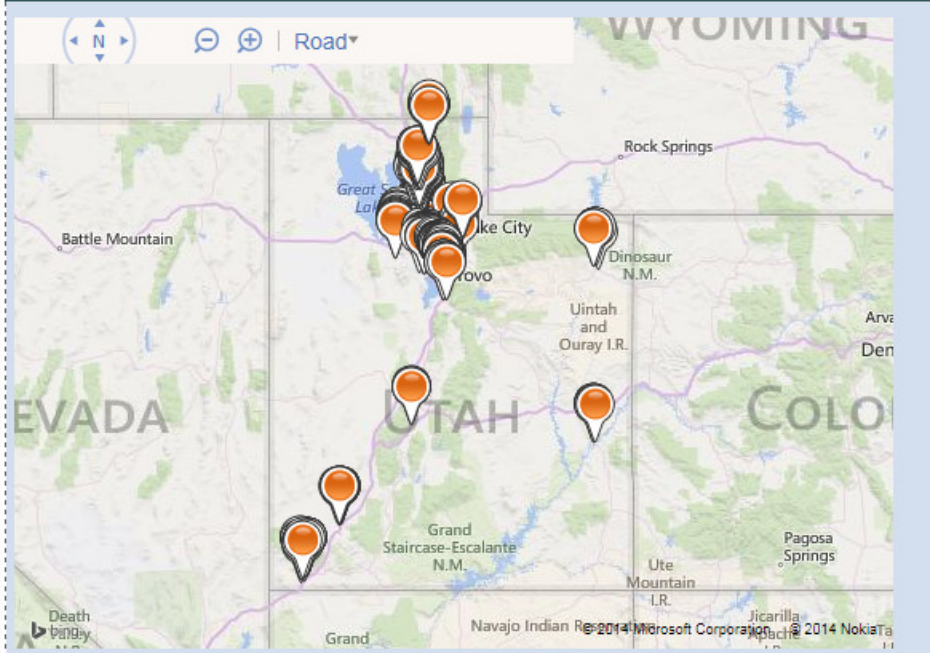
Region

Metric Type

Filter

Signal List

Map



Metric Settings

Metric Type

- ☐ Approach Delay
 ☐ Purdue Phase Termination
☐ Approach Volume
 ☐ Speed
☐ Arrivals On Red
 ☒ Split Monitor
☐ Purdue Coordination Diagram
 ☐ Turning Movement Counts

Y Axis Maximum

Percentile Split

- ☒ Show Plan Stripes
 ☒ Show % Max Out/ Force Off
☒ Show Ped Activity
 ☒ Show Percent Gap Outs
☒ Show Average Split
 ☒ Show Percent Skip
☐ Upload Current Data

Dates

Start Date

End Date

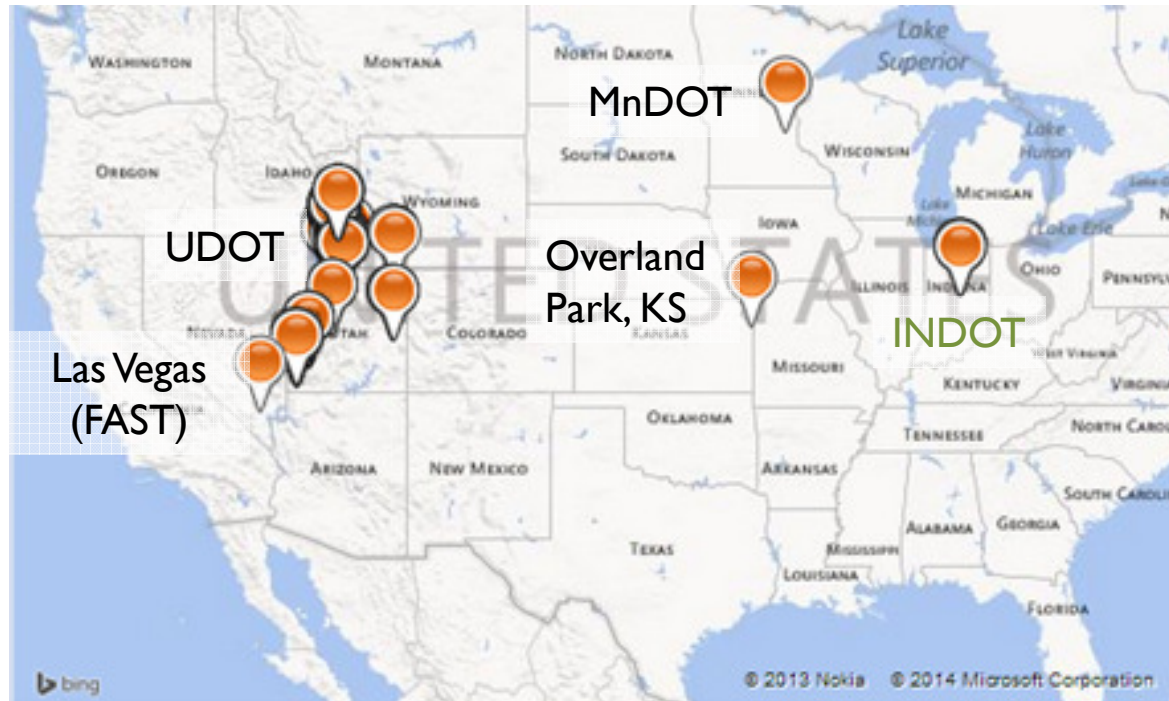
September 2014

Sun	Mon	Tue	Wed	Thu	Fri	Sat
31	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	1	2	3	4
5	6	7	8	9	10	11

<http://udottraffic.utah.gov/signalperformancemetrics>

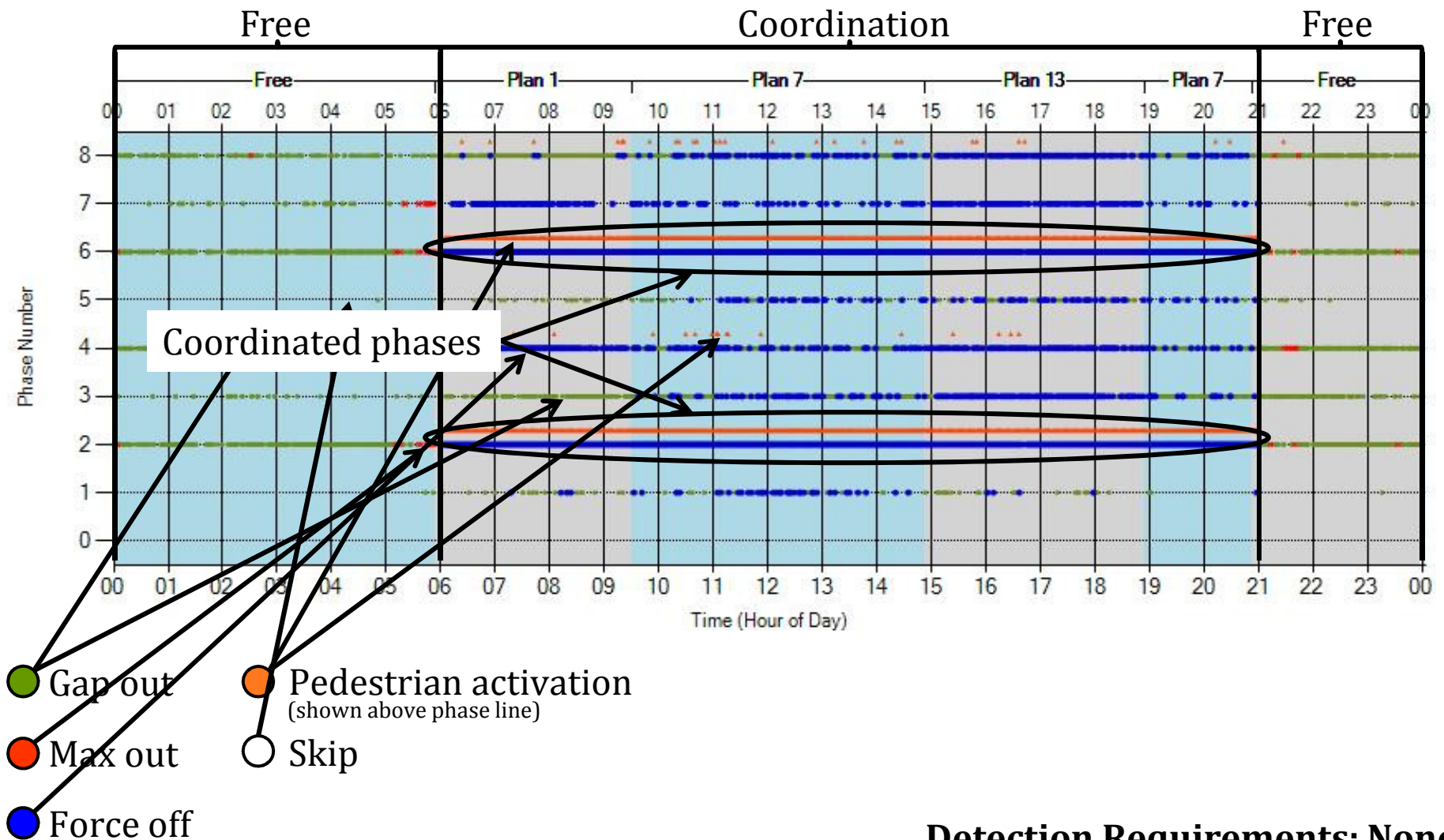
Agencies using UDOT SPM Software

Others are in the works
Ask us if you're interested!



<http://udottraffic.utah.gov/signalperformancemetrics>

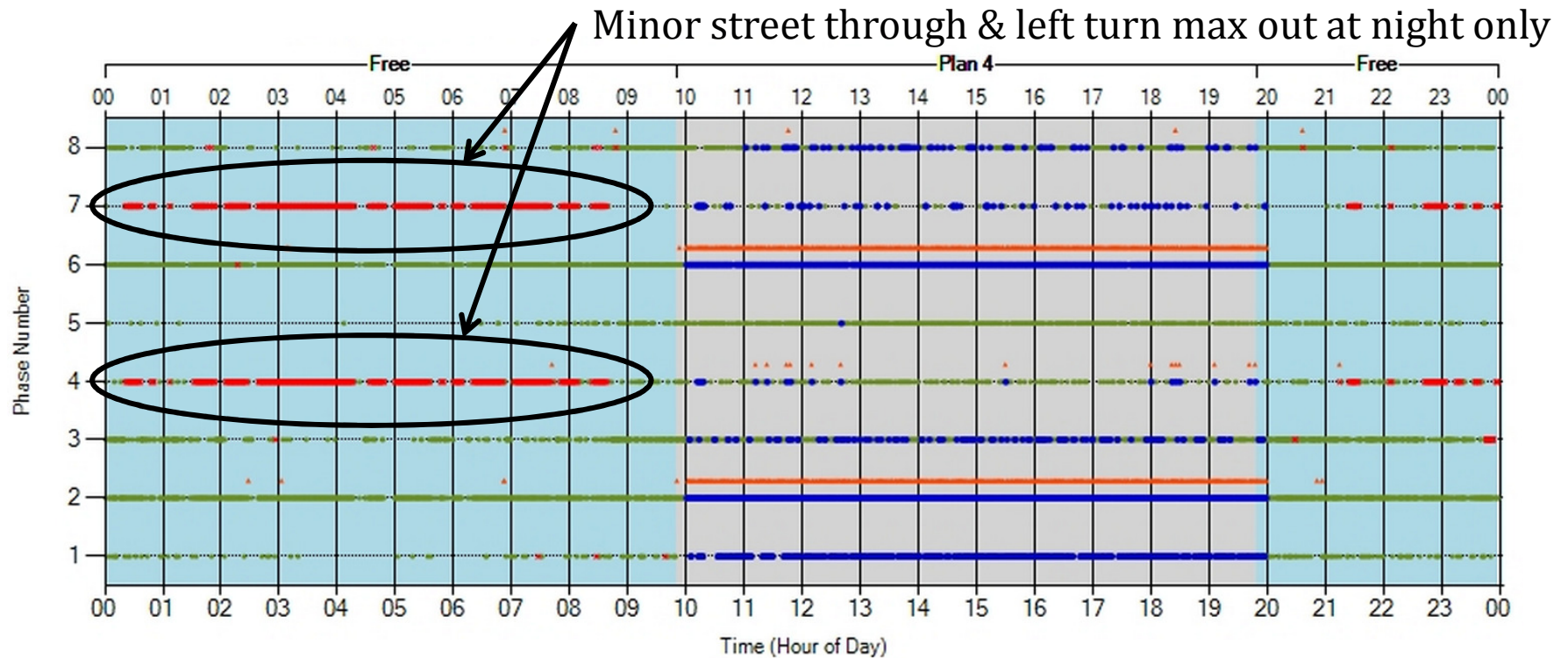
Purdue Phase Termination Chart



Detection Requirements: None

Maintenance Example: Nighttime detection problem

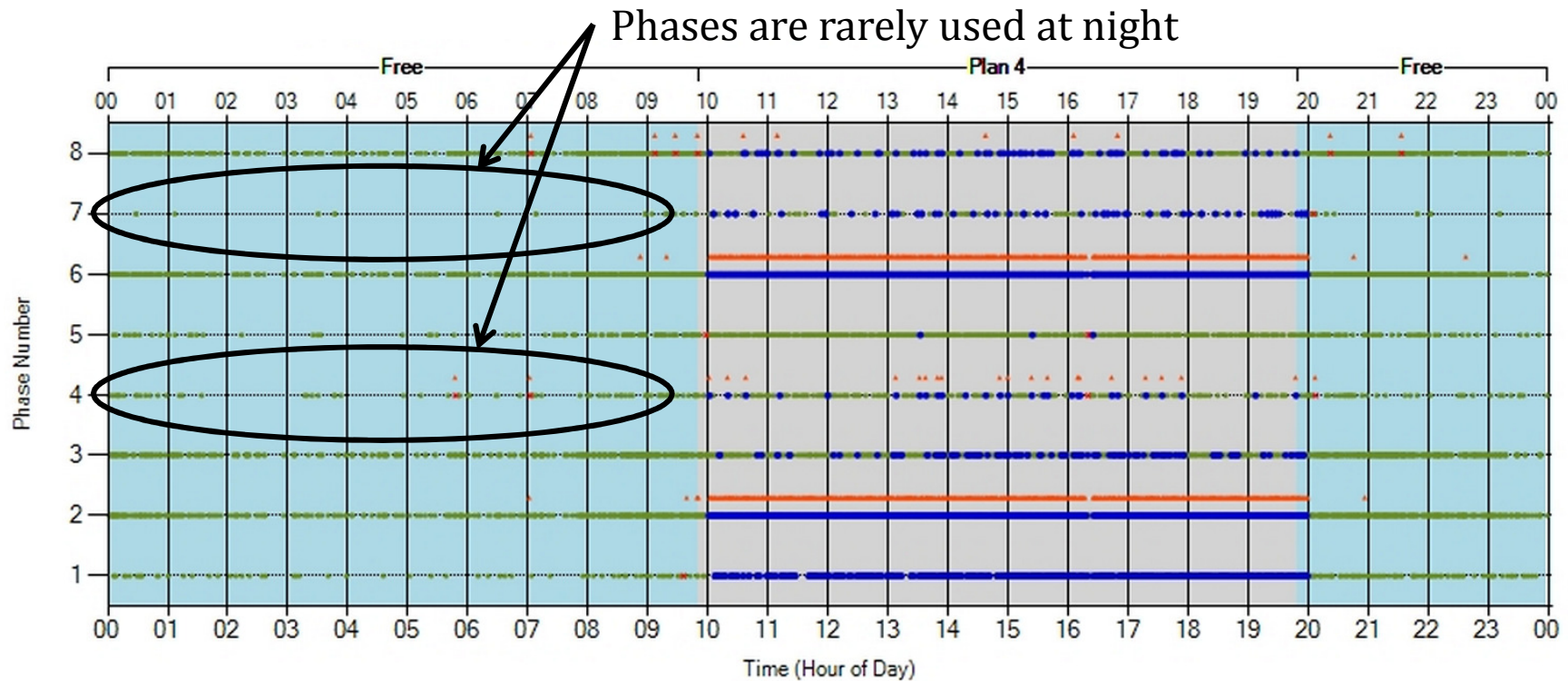
BEFORE: Video detection not working at night



- Gap out
- Pedestrian activation
(shown above phase line)
- Max out
- Skip
- Force off

Maintenance Example: Nighttime detection problem

AFTER: Detection repaired

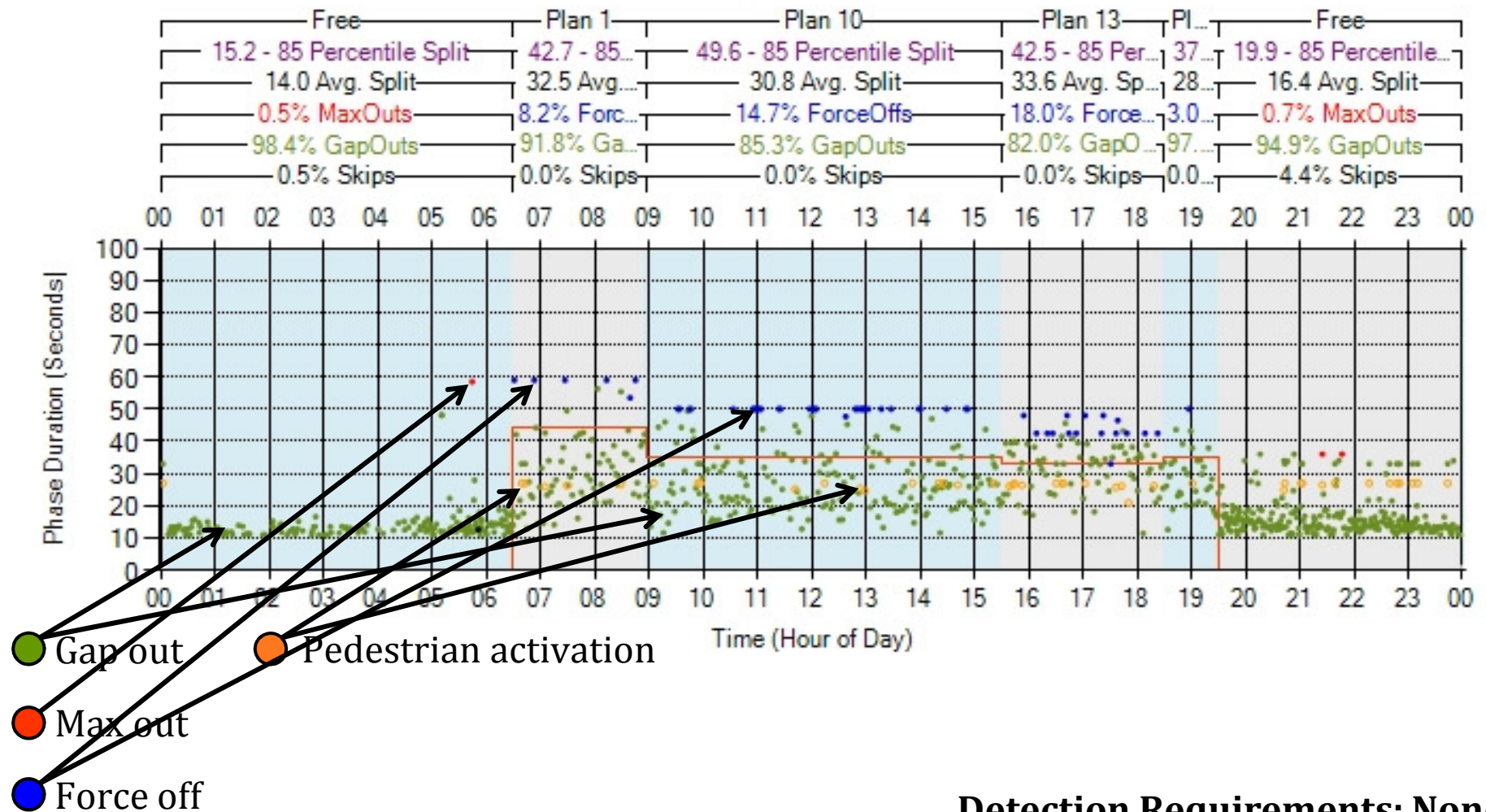


- Gap out
- Pedestrian activation
(shown above phase line)
- Max out
- Skip
- Force off

Split Monitor

1 of 8 phases shown

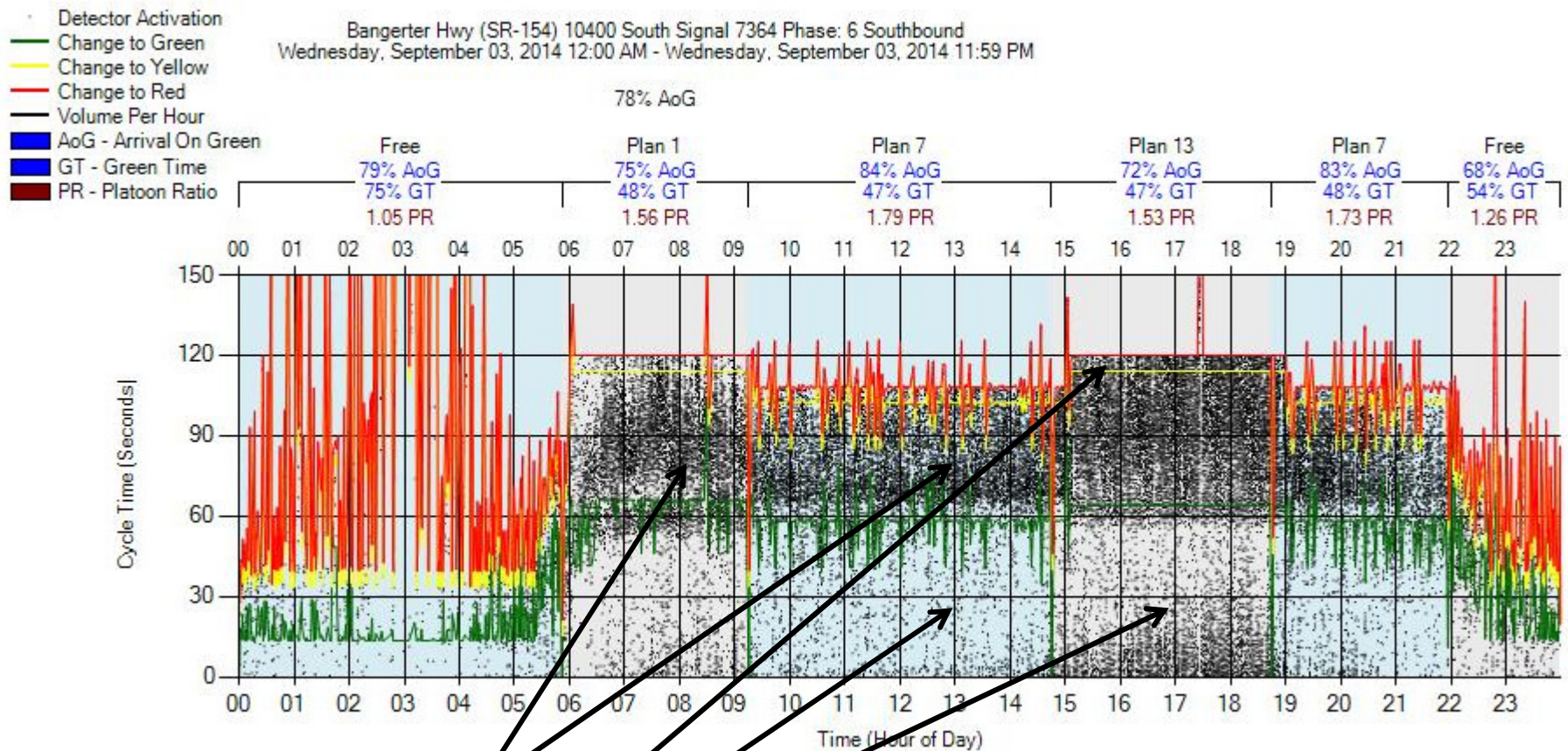
300 West 600 North SIG#7122 Phase 4
Wednesday, September 03, 2014 12:00 AM - Wednesday, September 03, 2014 11:59 PM



Detection Requirements: None

Purdue Coordination Diagram

One approach shown



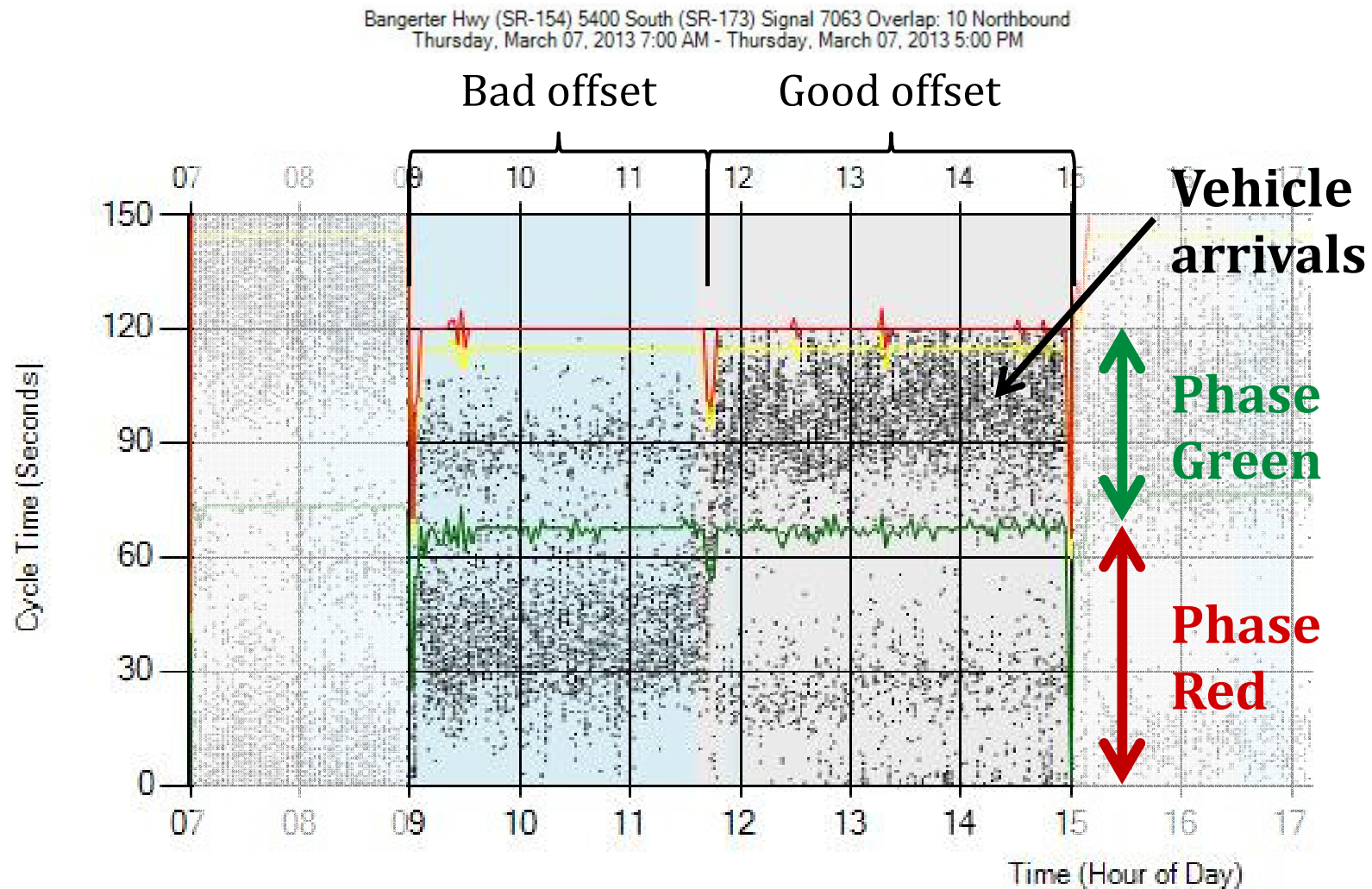
Vehicles arrive on green

Vehicles arrive on yellow

Vehicles arrive on red

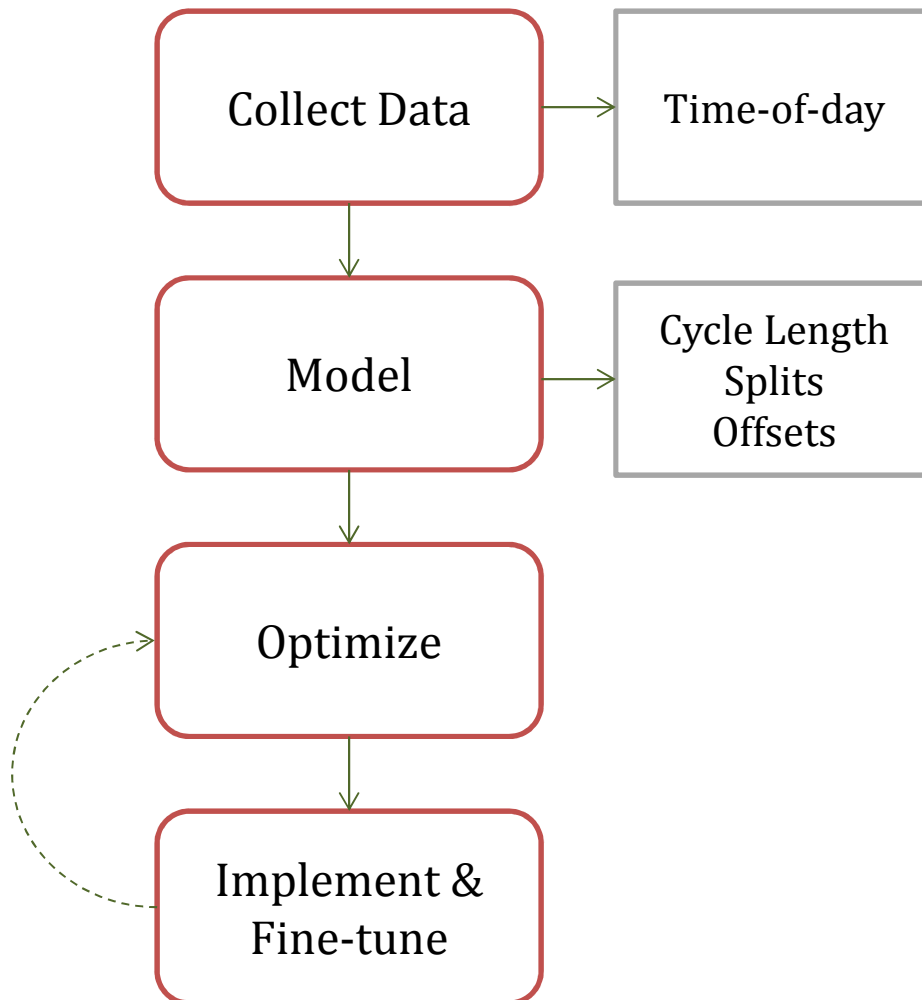
Detection Requirements: Advance Counters

Optimization Example: Progression Quality

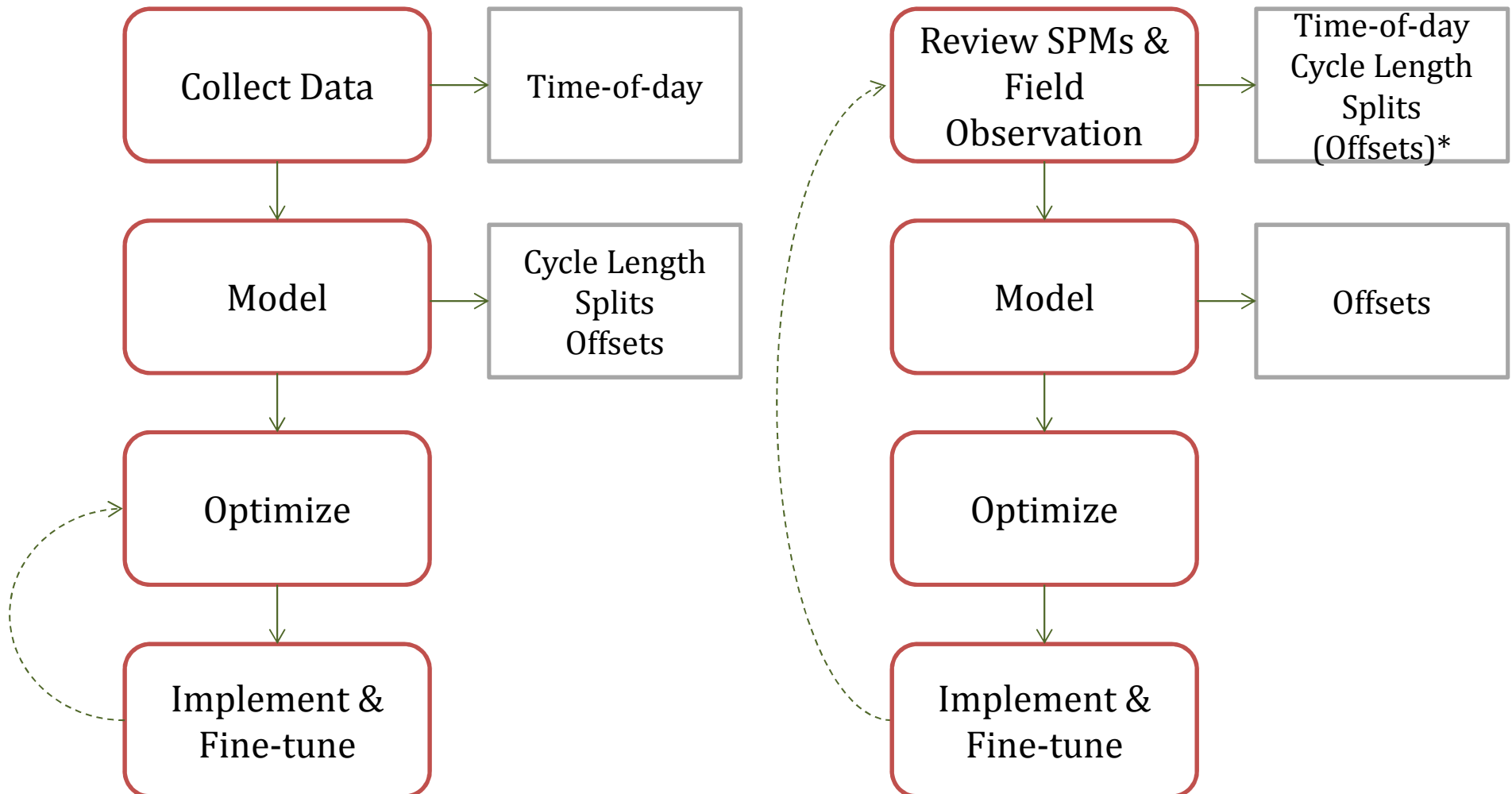


How SPM has changed our retiming process

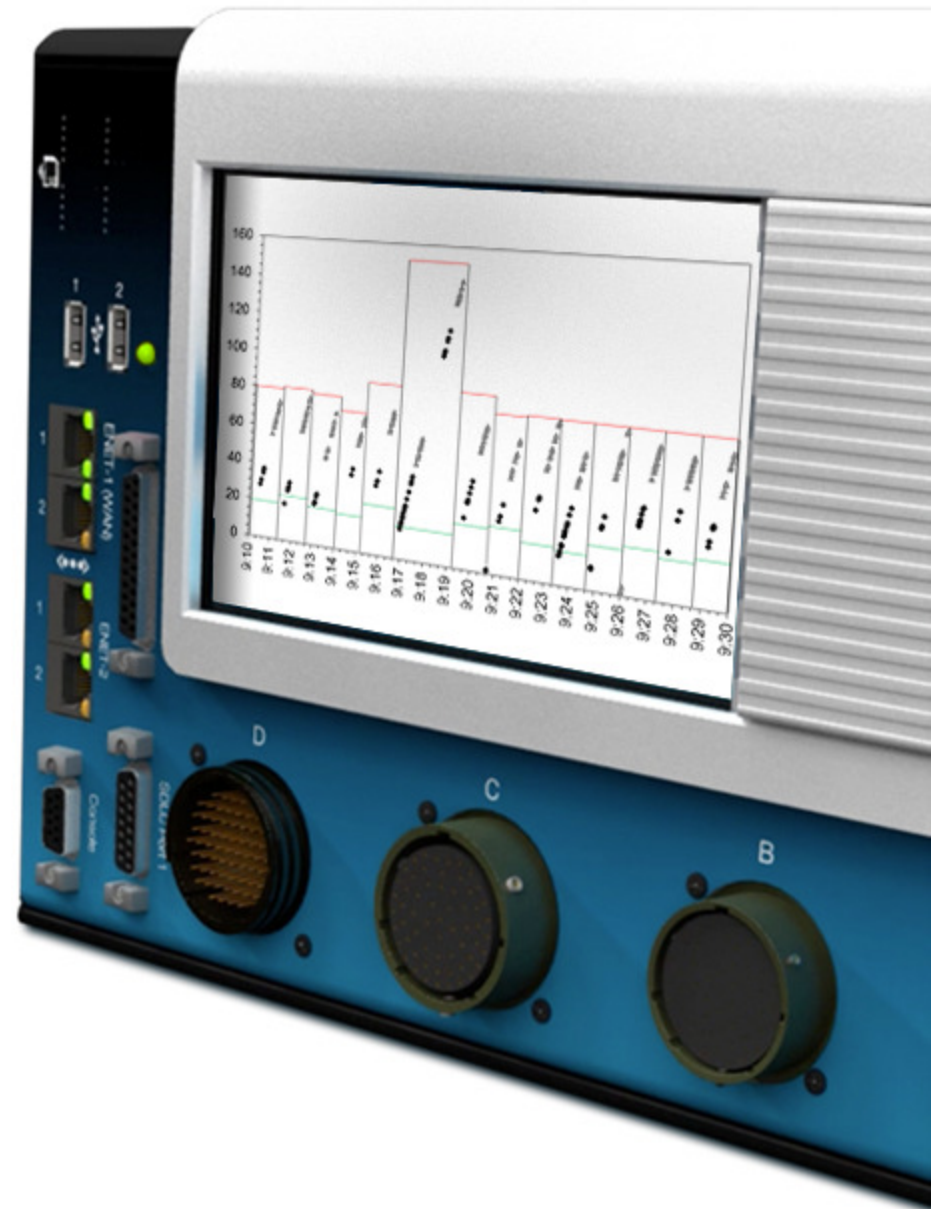
Traditional Process



Modified Process with SPMs



Future of SPM?



Find out more:
<http://aii.transportation.org>

AII


- AII Home
- About AII
- Membership
- Focus Technologies
- Executive Committee
- Feedback
- Additionally Selected Technologies
- AII-Solicitation
- Lead States Team Guidance

AII Home

AASHTO > AASHTO Innovation Initiative > AII Home

Formerly the AASHTO Technology Implementation Group, the *AASHTO Innovation Initiative* advances innovation from the grassroots up: by agencies, for agencies, peer-to-peer. The program actively seeks out proven advancements in transportation technology, investing time and money to accelerate their adoption by agencies nationwide. Each year, the program selects highly valuable technologies, processes, software, or other innovations that have been adopted by at least one agency, are proven in use, and will be of significant benefit to other agencies.

Recently selected technologies with links to additional information are listed below. Also, you may view *all* [Focus Technologies](#) and [Additionally Selected Technologies](#) categorized by AASHTO subcommittee interest area.



Lead States Team Focus Technologies

2014 Focus Technologies

- [Carbon Fiber Reinforced Polymer Strands](#)
- [e-Construction](#)
- [Right of Way Plans Index Site](#)

2013 Focus Technologies

- [Automated Traffic Signal Performance Measures](#)
- [UPlan Phase II](#)
- [Watershed Resources Registry](#)

Additionally Selected Technologies (ASTs)

2014 ASTs

- [Bridge Expansion Joint System](#)
- [Prep-ME Software](#)
- [Sandwich Plate System Bridge Decks](#)

2013 ASTs

- [Double Crossover Diamond Interchange](#)

Prior Four Years ASTs

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UDOT Signal Performance Metrics

<http://udottraffic.utah.gov/signalperformancemetrics>

Purdue/INDOT JTRP Report

<http://tinyurl.com/signalmoe>

AASHTO Innovation Initiative

<http://aii.transportation.org>